1. A reflective strain gauge, comprising:

an holographically-formed polymer dispersed liquid crystal (H-PDLC) film comprising layers of liquid crystal (LC) droplets in a matrix polymer, the H-PDLC film having a reflection or transmission grating capable of reflecting or transmitting light of a selected wavelength; and

means for securing the film to a surface of a workpiece for monitoring the strain at said surface.

2. A reflective strain gauge, comprising:

a film comprising aspected particles in an elastic polymer, said aspected particles comprising an holographically-formed polymer dispersed liquid crystal (H-PDLC) having layers of liquid crystal (LC) droplets in a matrix polymer, the H-PDLC having a reflection or transmission grating capable of reflecting or transmitting light of a selected wavelength; and

means for securing the film to a surface of a workpiece for monitoring the strain at said surface.

3. The gauge of claim 1 or 2, wherein the film comprises multiple gratings.

4. The gauge of claim 3, wherein said multiple gratings are located within a single H-PDLC layer.

5. The gauge of claim 3, wherein said gauge comprises a plurality of H-PDLC layers each said layer having at least one grating.

6. The gauge of claim 3, wherein different gratings are responsive to stress

applied in different directions.

7. The gauge of claim 1, wherein said grating is oriented within said H-PDLC film so that surface strain is observed as a blue shift of the reflected or transmitted light.

8. The gauge of claim 1, wherein said grating is oriented within said H-PDLC film so that surface strain is observed as a red shift of the reflected or transmitted light.

9. The gauge of claim 1, wherein the intensity of the reflected or transmitted light is polarization dependent.

10. The gauge of claim 1, wherein the grating of the H-PDLC film is oriented such that the LC refractive index parallel to said axis (n_e) is greater than the LC refractive index perpendicular to said axis (n_o).

11. The gauge of claim 10, wherein n_o substantially matches the refractive index of the matrix polymer.

12. The gauge of claim 10, wherein the LC droplets in a strained state form ellipsoids with long axes aligned parallel to an axis of an applied force.

13. The gauge of claim 10, wherein LC molecules of the LC droplets are aligned in a bipolar orientation.

14. The gauge of claim 1, wherein the matrix polymer is selected to have sufficient elasticity to sustain an applied strain without failure, said strain proportionate to a strain of a workpiece.

15. The gauge of claim 1, wherein the elastic polymer is selected to have sufficient elasticity to sustain an applied strain without failure, said strain proportionate to a strain of a workpiece.

16. The gauge of claim 1, wherein the LC layers are substantially parallel to the film surface.

17. The gauge of claim 1, wherein the LC layers are substantially perpendicular to the film surface.

18. The gauge of claim 1, wherein the layers are at an angle to the film surface.

19. The gauge of claim 2, wherein said aspected particles have an aspect ratio in the range of at least 4:1.

20. The gauge of claim 2, wherein said aspected particles have an aspect ratio in the range of at least 10:1.

21. A method for detecting strain in an article, comprising:

attaching a reflective strain gauge to a surface of an article, the strain gauge comprising an holographically-formed polymer dispersed liquid crystal (H-PDLC)

film having layers of liquid crystal (LC) droplets in a matrix polymer and having a reflection or transmission grating capable of reflecting or transmitting light of a selected wavelength; and

illuminating the film with light and monitoring for a change in the reflected or transmitted light, said change associated with strain in the article.

22. The method of claim 21, wherein the change in the reflected light comprises a change in the wavelength of the reflected light.

23. The method of claim 21, wherein the change in the reflected light comprises a change in the intensity of the reflected light.

24. The method of claim 21, wherein said strain is the result of a compressive force.

25. The method of claim 21, wherein said strain is the result of a tensile force.

26. The method of claim 21, wherein the film is positioned such that when a tensile force is applied, the spacing between the layers contracts.

27. The method of claim 26, wherein the tensile force is applied along the long axis of the LC droplet layers.

28. The method of claim 21, wherein said shift is a blue shift of the reflected or transmitted light.

29. The method of claim 21, wherein the film is positioned such that when a tensile force is applied, the spacing between the layers expands.

30. The method of claim 29, wherein the tensile force is applied along a direction transverse to the long axis of the LC droplets layers.

31. The method of claim 21, wherein said shift is a red shift of the reflected or transmitted light.

32. The method of claim 21, wherein the step of illuminating the film comprises illuminating the film with polarized light.

33. The method of claim 32, wherein in the strained state the LC droplets form ellipsoids with long axes aligned parallel to an axis of an applied force, such that the refractive index parallel to said axis (n_e) is greater than the refractive index perpendicular to said axis (n_o).

34. The method of claim 33, wherein light polarized perpendicular to said axis is transmitted, and light polarized parallel to said axis is reflected.

35. The method of claim 21, wherein the matrix polymer is selected to have sufficient elasticity to sustain strain without failure, said strain proportional to the strain of the article.

36. The method of claim 21, wherein the LC layers are substantially parallel to the article surface.

37. The method of claim 21, wherein the LC layers are substantially perpendicular to the article surface.

38. The method of claim 21, wherein the layers are at an angle to the article surface.

39. The method of claim 21, wherein the step of monitoring the wavelength shift is accomplished by a technique selected from the group consisting of visual observation, photodiode observation and spectrophotometry.

40. The method of claim 21, wherein the film comprises multiple reflection gratings.

41. The method of claim 21, wherein the gauge is responsive to stresses applied in different directions.

42. The method of claim 40, wherein said multiple gratings are located within a single H-PDLC layer.

43. The method of claim 40, wherein said film comprises a plurality of H-PDLC layers and each said layer comprises at least one grating.

44. The method of claim 21, wherein the applied strain is in the range of up to about 21%.

45. The method of claim 21, wherein said film comprises aspected particles

embedded in an elastic polymer, said aspected particles comprising an H-PDLC material comprising layer of LC droplets in a matrix polymer, wherein said aspected particles orient along a direction of an applied force when stressed.

46. A polarization-sensitive reflective display, comprising:

an holographically-formed polymer dispersed liquid crystal (H-PDLC) film comprising layers of liquid crystal (LC) droplets in a matrix polymer, the H-PDLC film having a reflection grating capable of reflecting light of a selected wavelength,

wherein the reflection grating of the H-PDLC film is oriented, such that the refractive index parallel to said axis of orientation (η_e) is greater than the refractive index perpendicular to said axis (η_o).

47. The display of claim 46, wherein orientation is attained by application of a strain, such that in the strained state the LC droplets form ellipsoids with long axes aligned parallel to the axis of the applied strain.

48. The display of claim 46, further comprising:

a polar molecule, wherein said polar molecule promotes orientation of said LC droplets.

49. The display of claim 49, wherein said polar molecule comprises an azo dye.

50. The display of claim 49, wherein said azo dye is selected from the group consisting of Congo red, azobenzene, methyl orange, methylenene blue and crystal violet.

51. The display of claim 46, wherein n_o substantially matches the refractive index of the matrix polymer.

52. A polarizing light filter, comprising:

an holographically-formed polymer dispersed liquid crystal (H-PDLC) film comprising layers of liquid crystal (LC) droplets in a matrix polymer, the H-PDLC film having a reflection grating capable of reflecting light of a selected wavelength,

wherein the reflection grating of the H-PDLC film is oriented, such that the refractive index parallel to said axis of orientation (n_e) is greater than the refractive index perpendicular to said axis (n_o).

53. A method of preparing an holographic polymer dispersed liquid crystal (H-PDLC) film, comprising:

providing a film comprised of a mixture of liquid crystal, a polar molecule and a photo-polymerizable monomer;

illuminating the film with light of an energy sufficient to orient the polar molecule but insufficient to initiate polymerization of the photo-polymerizable monomer; and

illuminating the film with at least one holographic light pattern to obtain an holographically-formed polymer dispersed liquid crystal (H-PDLC) film comprising layers of liquid crystal (LC) droplets in a matrix polymer wherein the LC droplets contain bipolar LC molecules.